REMARKS

The Official Action rejects Claims 1 and 2 under 35 U.S.C. § 102(b) as being anticipated by an article entitled *Damage Diagnosis Using Time Series Analysis of Vibration Signals* by Hoon Sohn, et al. (hereinafter the "Sohn article"). The Official Action also rejects Claims 3 and 4 under 35 U.S.C. § 103(a) as being unpatentable over the Sohn article in view of an article entitled *Auto-Regressive Time Series Modeling Of Stochastic Surfaces* by B. Naga Prasada Rao, et al. (hereinafter the "Rao article"). Finally, the Official Action rejects Claim 5 under 35 U.S.C. § 103(a) as being unpatentable over the Sohn article in view of the Rao article and in further view of U.S. Patent No. 4,030,208 to Fred F. Carver, et al. As described in more detail below, independent Claim 1 has been amended in order to further patentably distinguish the claimed invention from the cited references, taken either individually or in combination. Based upon the amendments to independent Claim 1, dependent Claim 3 has also been amended for purposes of consistency. Based on the foregoing amendments and the following remarks, reconsideration of the present application and allowance of the claims are respectfully requested.

As set forth by independent Claim 1, a method of simulating service loads includes: (A) developing a service load history database including multiple time series models representative of different service load conditions, (B) combining the multiple time series models to form a simulation test service load model for a time span of a testing object with each time series model being included in the simulation test service load model in a proportion that is based on the estimated time within the time span for which the service load condition associated with the respective time series model will be applicable, (C) adjusting a variance of each of the time series models and creating an accelerated service load model, (D) regenerating random vibration load data based upon the accelerated service load model and (E) feeding the load data to a drive simulation system in order to cause the drive simulation system to simulate service loads in accordance with the random vibration load data.

By way of background and as described on pages 3 and 4 of the present application, time series models are developed that are representative of different service loads. For example, page 4, lines 22-24 of the present application identifies exemplary service loads as those created by road surface fluctuations or fluctuations of wind pressures, *e.g.*, wind gusts. For each service load of interest, a time series model is developed and stored to permit future reconstruction of the service loads. For example, page 5, lines 8-11 of the present application notes that different time series models may be constructed to represent the service loads attributable to travel over a sand road, a concrete road, a soil road and an asphalt road.

Once the time series models have been developed, the time series models are combined as described on page 5, lines 4-11 of the present application. As now set forth by amended independent Claim 1 and as noted on page 4, lines 5-8 of the present application, multiple times series models, each representative of a different service load, may be combined into the simulation test service load model in different proportions with the proportion of each time series model depending upon the estimated time during which the object under test will be subjected to the respective service load during the time span of interest. For example, if a vehicle under test is anticipated to travel over asphalt roads for 80% of its life and over gravel for 20% of its life, the resulting combination of the time series models would weight the time series model representative of the service loads to which the vehicle is subjected while traveling over an asphalt road by 80% and the time series model representative of the service loads to which the vehicle are subjected while traveling over a gravel road by 20%. This aspect of the claimed invention is now defined by independent Claim 1 which has been amended to recite that "each time series model is included in the simulation test service load model in a proportion that is based on an estimated time within the time span for which the service load condition associated with the respective time series model will be applicable".

In order to create an accelerated service load model, a parameter of each of the time series models is adjusted. In this regard, independent Claim 1 has been further amended to specify that the variance of each time series model is adjusted. By changing the value of the variance σ_a^2 in the resulting time series models, the resulting service load

model is accelerated without altering the sequencing or the shape of the autospectrum of the reconstructed signals. *See* page 5, lines 12-16 of the present application.

Thereafter, random vibration load data is regenerated based upon the accelerated service load model. As described on page 5, line 18 – page 6, line 5 of the present application, the random vibration load data may be generated in a recursive manner based upon a series of random data $a_1, a_2 \ldots$ with the random data being generated such that the mean of the random data is zero and the standard deviation of the random data is σ_a. The random vibration load data is then utilized to drive a simulation system, such as by converting the load data into digital signals (see Figure 2) that may then be utilized to "drive a computer-controlled actuator to simulate ground fluctuations, vibrations caused by propulsion systems, and/or vibrations caused by ocean waves, etc." *See* page 6, lines 8-10 of the present application.

As described below, none of the cited references, taken either individually or in combination, teach or suggest the method of amended independent Claim 1. With respect to the cited references, the Sohn reference describes a structural health monitoring technique. In accordance with this technique, multiple time series are recorded in response to the application of different input force levels to an undamaged structure. This collection of time series is called "the reference database." A different auto-regressive (AR) model is then constructed for each respective time series. Following the passage of time and/or use of the structure, additional measurement data is collected, such as by an array of sensors. The measurement data is then individually compared to that predicted by each of the AR models and the residual error $\varepsilon_x(t)$ attributable to damage to the structure is determined. By further analyzing the residual error, the Sohn article indicates that an estimate as to the location of the damage may also be provided.

Since the Sohn article is directed to structural health monitoring as opposed to the simulation of service loads as in the claimed invention, there are numerous basic differences between the Sohn article and the claimed invention. For example, the random vibration signals represented in the time series in the Sohn article are the dynamic response measurements of a structure that are excited by the input forces. The responses are recorded in terms of acceleration, not displacement, at a record location of the

structure. In contrast, the random vibration signals of the claimed invention represent exciting loads that, in turn, represent service loads. Additionally, the accelerated service load model of the claimed invention is strengthened in a particular manner, by adjusting the variances, in order to reduce the testing time while maintaining the time sequences of the service loads as well as to maintain the meaningful, quantified relationship between the increase in strength and the reduction in testing time. In contrast, the acceleration histories of the Sohn article are the vibration responses caused by service loads that have acted upon the structure.

More particularly with respect to the recitations of amended independent Claim 1, the Sohn article does not teach or suggest that "each time series model is included in the simulation test service load model in a proportion that is based on an estimated time within the time span for which the service load condition associated with the respective time series model will be applicable", as now set forth by amended independent Claim 1. Indeed, the only manner in which the time series are combined is that identified by page 3 of the Official Action in that the multiple time series are stored in a database. While the multiple time series may be stored in a database, the multiple time series models are not combined "in a proportion that is based on an estimated time within the time span for which the service load condition associated with each respective time series model will be applicable", as set forth by amended independent Claim 1. Further, while the AR models are constructed from the respective time series and each AR model is then individually utilized as a point of comparison for data measurements, there is no teaching or suggestion relating to the combination of multiple time series or the combination of multiple AR models in proportion to an estimated time for which the service load condition associated with each respective time series model will be applicable, as per the claimed invention. The other cited references also fail to teach or suggest the combination of the multiple time series models and, indeed, are not cited for this proposition.

The Sohn article also fails to teach or suggest adjusting a variance of each of the time series models to create an accelerated service load, as now also set forth by amended independent Claim 1. In conjunction with its analysis of dependent Claim 3, the Official

Action notes the deficiency of the Sohn article with respect to the adjustment of the variance of each time series models and cites the Rao article for its disclosure. While the Rao article does note that various data sequences have different variances, the Rao article also fails to teach or suggest that the variance of each time series model is adjusted. Moreover, while the Sohn article does describe the standardization of the time signals, this standardization does not create an accelerated service load model as set forth by the claimed invention. Since the Carver '208 patent also fails to teach or suggest the adjustment of the variance of a time series model to create an accelerated service load model, none of the cited references, taken either individually or in combination, teach or suggest this recitation of independent claim 1, as amended.

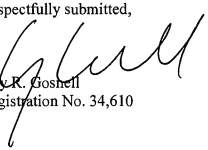
For each of the foregoing reasons, the method of independent claim 1 is not taught or suggested by the Sohn article, taken either individually or in combination with the Rao article and the Carver '208 patent. Dependent claims 2-5 include each of the recitations of independent claim 1 and, as a result, are patentably distinct from the cited references, taken either individually or in combination, for at least for the same reasons as described above in conjunction with independent claim 1. For each of the foregoing reasons, the rejections of the claims under 35 U.S.C. §§ 102 and 103 are therefore overcome.

CONCLUSION

In view of the amendments to the claims and the abstract and the remarks presented above, it is respectfully submitted that all of the claims of the present application are in condition for immediate allowance. It is therefore respectfully requested that a Notice of Allowance be issued. The Examiner is encouraged to contact Applicants' undersigned attorney to resolve any remaining issues in order to expedite examination of the present application.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,



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